WHAT IS CLAIMED IS:

1. A microfluidic device comprising:
a loop channel communicating with at least one service channel,
a microvalve separating the loop channel from the service channel,
a pump associated with the loop channel.

2. A device of claim 1, wherein the at least one service channel comprises at least one inlet and one outlet.

3. A device of claim 1, wherein the pump is a peristaltic pump.

4. A device of claim 2, wherein each inlet and outlet is separated from the loop channel by a microvalve, and wherein the pump comprises at least three cooperating microvalves acting within the loop channel.

5. A device of claim 1, further comprising a set of target molecules disposed within the loop channel.

6. A device of claim 1, wherein the pump comprises at least three cooperating microvalves acting within the loop channel, and further comprising a set of target molecules disposed within the loop channel.

7. A device of claim 5, wherein the target molecules are polynucleotide probes.

8. A device of claim 5, wherein the target molecules are protein probes.

9. A device of claim 5, wherein the target molecules are antibodies.

10. A device of claim 5, further comprising at least one detection region coincident with at least a portion of the loop channel.

11. A device of claim 6, further comprising at least one detection region coincident with at least a portion of the loop channel and at least one detector associated with at least one detection region.

12. A device of claim 1, wherein the loop channel resides in a layer of elastomeric material.

13. A device of claim 4, wherein the loop channel resides in a layer of elastomeric material, and the valves are formed from an elastomeric membrane.

14. A device of claim 6, wherein the loop channel resides in a layer of transparent elastomeric material and the valves are formed from an elastomeric membrane.

15. A device of claim 14, further comprising at least one detection region coincident with at least a portion of the loop channel.

16. A device of claim 12, wherein the elastomeric layer is adjacent to a substrate layer.

17. A device of claim 13, further comprising at least one detection region coincident with at least a portion of the loop channel, and wherein the elastomeric layer is adjacent to a transparent substrate layer.

18. A device of claim 14, wherein the elastomeric layer is adjacent to a transparent substrate layer.

19. A device of claim 1, wherein the loop and service channels reside in a treatment layer, and further comprising a control layer adjacent to the treatment layer and carrying control lines.

20. A device of claim 19, wherein the treatment and control layers are elastomeric.

21. A device of claim 20, wherein the treatment and control layers are bonded to each other.

22. A device of claim 21, wherein at least one of the treatment and control layers is transparent.

23. A device of claim 19, wherein the control lines comprise at least one channel which is carried by the control layer and which intersects at least one channel carried by the treatment layer.

24. A device of claim 23, wherein at least one intersection of channels forms a microvalve.

25. A device of claim 24, wherein the microvalve comprises a deformable membrane between a treatment channel and a control channel.

26. A device of claim 24, wherein the control channels are supplied with a pressurized fluid.

27. A device of claim 25, wherein the control channels are supplied with air.

28. A device of claim 27, further comprising a transparent substrate layer adjacent to at least one of the treatment and control layers, and wherein at least one of the treatment and control layers is also transparent.

29. A device of claim 25, further comprising a set of target molecules disposed within the loop channel and at least one detection region coincident with at least a portion of the loop channel.

30. A device of claim 29, wherein the loop channel is circular.

31. A microfluidic device comprising:

a treatment layer having elastomeric fluid channels comprising a loop channel, a loop inlet channel, and a loop outlet channel,

a control layer adjacent to the treatment layer and having elastomeric control channels, wherein at least one control channel intersects each of the inlet and outlet channels to form microvalves, and at least three control channels intersect the loop channel to form a peristaltic pump.

32. A device of claim 31, wherein the elastomeric material is transparent.

33. A device of claim 31, wherein target molecules are disposed in the loop channel.

34. A device of claim 33, wherein the target molecules are patterned on a surface of the loop channel.

35. A device of claim 34, wherein the patterned surface is a transparent substrate that seals at least a portion of the length of the loop channel.

36. A device of claim 31, wherein the control channels receive a pressurized gas.

37. A device of claim 36, wherein the loop channel receives fluid from the inlet channel.

38. A device of claim 37, wherein the fluid is an aqueous liquid and the pressurized gas is air.

39. A device of claim 38, wherein target molecules are in the loop channel, and further comprising at least one detection region coincident with at least a portion of the loop.

40. A device of claim 39, wherein the target molecules are patterned on a transparent substrate that seals at least a portion of the length of the loop channel.

41. A device of claim 40, wherein the pattern of target molecules coincides with a detection region examined by an optical detector.

42. A device of claim 41, wherein the target molecules are labeled with a reporter.

43. A device of claim 41, wherein the target molecules are labeled with a fluorescent reporter.

44. A device of claim 41, wherein target molecules are polynucleotdies.

45. A device of claim 41, wherein target molecules are polypeptides.

46. A device of claim 41, wherein target molecules are antibodies.

47. A device of claim 31, wherein the elastomer is a molded silicon elastomer.

48. A device of claim 31, wherein channels are formed by soft lithography.

49. A device of claim 31, further comprising at least one mixing channel in communication with a loop inlet channel.

50. A device of claim 49, wherein the mixing channel is on the treatment layer and has at least one microvalve provided by an intersecting control channel on the control layer.

51. A microfluidic device according to claim 1, wherein the loop channel comprises at least one pair of interconnected parallel and antiparallel channels.

52. A microfluidic device according to claim 51, wherein the loop channel comprises a plurality of pairs of interconnected parallel and anti-parallel channels.

53. A device according to claim 31 wherein the control lines comprise at least three parallel channels which are carried by the control layer, in which each of the at least three parallel channels intersects at least one channel carried by the treatment layer.

54. A microfluidic device according to claim 31 wherein the loop channel comprises at least one pari of interconnected parallel and antiparallel channels.

55. A microfluidic device according to claim 54 wherein the loop channel comprises a plurality of pairs of interconnected parallel and antiparallel channels.

56. A microfluidic device according to claim 31 wherein the at least three control channels are parallel channels.

57. A microfluidic device comprising:

a plurality of loop channels, each loop channel communicating with at least one service channel; and

a pump associated with each of the plurality of loop channels.

58. A microfluidic device according to claim 57 wherein the pump associated with a loop channel comprises at least three cooperating microvalves acting within the loop channel.

59. A microfluidic device according to claim 57 wherein a set of target molecules is disposed within each loop channel.

60. A microfluidic device comprising:

a treatment layer having elastomeric fluid channels comprising at least one inlet channel, at least one outlet channel, and a plurality of loop channels; and

a control layer adjacent to the treatment layer and having a plurality of parallel elastomeric control channels, wherein at least three control channels intersect each loop channel to form a peristaltic pump.

61. A microfluidic device according to claim 60 wherein a set of target molecules is disposed within each loop channel.

62. A microfluidic device according to claim 61 wherein the target molecules are patterned on a substrate that seals at least one portion of the length of each loop channel.

63. A microfluidic device according to claim 62, wherein

the substrate is a microtiter plate having microtiter wells, each microtiter well having a target molecule patterned thereon; and

the microtiter plate is connected to the treatment layer so that at least a portion of the length of each loop channel is sealed by a microtiter well.

64. A microfluidic device according to claim 63, wherein the microtiter plate comprises 96 microtiter wells.

65. A microfluidic device according to claim 63, wherein the microtiter plate comprises 384 microtiter wells.

66. A microfluidic device according to claim 63 wherein the microtiter plate comprises 1536 microtiter wells.

67. A microfluidic device according to claim 57 having 96 target loops.

68. A microfluidic device according to claim 57 having 384 target loops.

69. A microfluidic device according to claim 57 having 1536 target loops.

70. A method for mixing two or more different fluids in a microfluidic device, which method comprises:

(a) introducing the different fluids to a microfluidic device,

the microfluidic device having:

(i) a loop channel communicating with at least one service channel,

(ii) a microvalve separating the loop channel from the service channel, and

(iii) a pump associated with the loop channel,

so that each of the different fluids is loaded into the loop channel; and

(b) activating the pump associated with the loop channel to mix the different fluids.

71. A method according to claim 70, wherein the microfluidic device has at least one inlet channel and at least one outlet channel, the different fluids being loaded into the loop channel through at least one inlet channel.

72. A method according to claim 71, wherein:

the microfluidic device has two or more inlet channels; and

each of the two or more different fluids is loaded into the loop channel through a different inlet channel.

73. A method according to claim 71, wherein each inlet channel and each outlet channel is separated from the loop channel by a microvalve.

74. A method according to claim 73, wherein the microvalves separating the inlet and outlet channels from the loop channel are closed while the pump is activated.

75. A method according to claim 73, wherein the microvalves separating the inlet and outlet channels from the loop channel remain open while the pump is activated.

76. A method according to claim 70 wherein the pump is a peristaltic pump.

77. A method according to claim 76 wherein the peristaltic pump comprises at least three cooperating microvalves acting within the loop channel.

78. A method according to claim 70, wherein at least one of the different fluids comprises a solution of molecules.

79. A method according to claim 78, wherein the solution of molecules contains molecules selected from a group consisting of: nucleic acid molecules, polypeptide molecules, antibody molecules,

80. A method according to claim 70, wherein at least one of the different fluids comprises a suspension of particles.

81. A method according to claim 80, wherein the suspension of particles contains particles selected from a group consisting of: cells, virions, and microscopic beads.

82. A method for binding a sample to a target, which method comprises:

(a) introducing a fluid containing the sample to a microfluidic device, the microfluidic device having:

(i) a loop channel communicating with at least one service channel and having molecules of the target disposed therein,

(ii) a microvalve separating the loop channel from the service channel, and

(iii) a pump associated with the loop channel,

so that the fluid containing the sample is loaded into the loop channel; and

(b) activating the pump so that the fluid through the loop,

wherein the sample binds to the target molecules disposed in the loop as the fluid circulates therethrough.

83. A method according to claim 82, wherein the target molecules are selected from a group consisting of polynucleotide probes, protein probes, antibody probes, biotin and avidin.

84. A method according to claim 82, wherein the sample comprises nucleic acid molecules, protein molecules, cells or virions.

85. A method according to claim 84, wherein:

the sample comprises nucleic acid molecules, and

the target comprises polynucleotide probes specific for nucleic acid molecules in the sample.

86. A method according to claim 84, wherein:

the target comprises biotin molecules, and

the sample comprises particles or molecules having a biotin specific label.

87. A method according to claim 86, wherein the biotin specific label is avidin or NeutrAvidin.

88. A method according to claim 82, wherein the pump is a peristaltic pump.

89. A method according to claim 88, wherein the peristaltic pump comprises at least three cooperating microvalves acting within the loop channel.

90. A method according to claim 82, wherein the loop channel resides in a layer of elastomeric material.

91. A method according to claim 90, wherein the layer of elastomeric material is adjacent to a surface of a substrate layer.

92. A method according to claim 91, wherein the surface of the substrate layer has molecules of the target attached thereto.